

Claims:

1. A magnetically shielded container (1) having
disposed in parallel opposed position on an axis (S)
5 thereof magnetic field homogenizing pole shoes (10.1,
10.2), having disposed about said pole shoes a
magnetically shielding yoke (2), said pole shoes and
yoke enclosing a magnetic chamber (26), said container
further comprising magnetic field sources (2.4,2.5)
10 disposed about and radially distanced from said axis
whereby there exists within said chamber substantially
homogeneous magnetic field B_0 oriented in the direction
of said axis and whereby there is a usable volume within
said chamber where the ratio of the magnetic field
15 gradient in the direction transverse to said axis to
said magnetic field B_0 has a value of no more than $1.5 \times 10^{-3}/\text{cm}$.
2. A container as claimed in claim 1 wherein said
20 ratio has a value of no more than $7 \times 10^{-4}/\text{cm}$.
3. A container as claimed in either of claims 1 and 2
wherein the ratio of the volume of said usable volume to
the volume of said chamber (26) is greater than 1:30.
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4. A container as claimed in either of claims 1 and 2
wherein the ratio of the volume of said usable volume to
the volume of said chamber (26) is greater than 1:5.
- 30 5. A container as claimed in either of claims 1 and 2
wherein the ratio of the volume of said usable volume to
the volume of said chamber (26) is greater than 1:2.
- 35 6. A container as claimed in any one of claims 1 to 5
wherein the volume of said usable volume is at least 50
mL.

7. A container as claimed in any one of claims 1 to 5 wherein the volume of said usable volume is at least 100 mL.

5 8. A container as claimed in any one of claims 1 to 5 wherein the volume of said usable volume is at least 200 to 2000 mL.

10 9. A container as claimed in any one of claims 1 to 8 wherein said pole shoes (10.1,10.2) are of μ -metal or soft iron.

15 10. A container as claimed in any one of claims 1 to 9 wherein said yoke (2) is of a material which is not magnetically saturatable at magnetic field strengths below 1 Tesla.

20 11. A container as claimed in any one of claims 1 to 9 wherein said yoke (2) is of a material which is not magnetically saturatable at magnetic field strengths below 2 Tesla.

25 12. A container as claimed in any one of claims 1 to 11 wherein said magnetic field sources (2.5) are disposed around the peripheries of each of said pole shoes (10.1, 10.2).

30 13. A container as claimed in claim 11 wherein said magnetic field sources are disposed between the side wall (2.2) and end walls (2.1.1,2.1.2) of said yoke.

35 14. A container as claimed in any one of claims 1 to 11 wherein said magnetic field sources (2.4) are disposed about said axis (S) on a plane (4) between said pole shoes (10.1,10.2)

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15. A container as claimed in claim 14 wherein said magnetic field sources (2.4) are disposed between two sections (2.3) of said yoke (2).

5 16. A container as claimed in any one of claims 1 to 11 wherein one array of magnetic field sources (2.5) is disposed around the peripheries of each of said pole shoes (10.1,10.2) and a further array of magnetic field sources (2.5) is disposed about said axis (S) on a plane
10 (4) between said pole shoes (10.1,10.2).

17. A container as claimed in claim 16 wherein said arrays (2.4,2.5) of magnetic field sources are disposed as defined in claims 12 and 14.

15 18. A container as claimed in any one of claims 1 to 17 further comprising a magnetic screen (40) disposed about said axis (S) within said yoke (2).

20 19. A container as claimed in any one of claims 1 to 18 further comprising at least one shim disposed about said axis (S) within said yoke (2).

25 20. A container as claimed in any one of the preceding claims for which the ratio between the total weight of the container (1) and the volume of the magnetic chamber (26) is no more than 1 kg/L.

30 21. A container as claimed in any one of the preceding claims for which the ratio between the total weight of the container (1) and the volume of the magnetic chamber (26) is no more than 0.2 kg/L.

35 22. A container as claimed in any one of the preceding claims for which the ratio between the total weight of the container (1) and the volume of the magnetic chamber (26) is no more than 1/30 kg/L.

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23. A container as claimed in any one of the preceding claims which is openable and sealingly closable.

5 24. A container as claimed in any one of the preceding claims wherein said pole shoes (10.1,10.2) are circular and said yoke (2) is substantially cylindrical.

10 25. A container as claimed in any one of the preceding claims wherein said pole shoes (10.1,10.2) are supported by magnetically resistant elements (16).

26. A container as claimed in claim 25 wherein said elements (16) are of rigid porous plastic.

15 27. A container as claimed in any one of the preceding claims further comprising a gas storage cell (20) disposed in said usable volume in said magnetic chamber (26).

20 28. A container as claimed in claim 27 wherein at least the inner walls of said cell are formed of a material essentially free of paramagnetic substances.

25 29. A container as claimed in claim 28 wherein said material is a very low iron concentration glass.

30 30. A container as claimed in claim 29 wherein said glass has an iron concentration of less than 20 ppm.

30 31. A container as claimed in any one of claims 27 to 30 wherein the walls of said cell (20) are uncoated.

35 32. A container as claimed in any one of claims 27 to 31 wherein the wall of said storage cell (20) is of a low iron content glass, the iron content being sufficiently low that the ratio between the wall-related depolarization relaxation time T_1^w for nuclear spin

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polarized ^3He and the volume-to-inner surface area of said cell is at least 10 hours/cm.

5 33. A container as claimed in any one of claims 27 to 32 wherein said cell (20) is provided with a valve (22) to permit introduction and removal of gas.

10 34. A container as claimed in any one of claims 27 to 33 wherein said cell (20) contains nuclear spin polarized gas.

35. A container as claimed in claim 34 wherein said gas is ^3He or ^{129}Xe or contains ^{19}F , ^{13}C or ^{31}P .

15 36. A container as claimed in any one of claims 27 to 35 wherein said cell (20) has an internal volume of at least 50 mL.

20 37. A container as claimed in any one of claims 27 to 35 wherein said cell (20) has an internal volume of between 100 mL and 1 m³.

25 38. A container as claimed in any one of the preceding claims in transportable form.

39. A container as claimed in any one of the preceding claims further comprising a magnetic field sensor (32) disposed within said magnetic chamber (26).

30 40. A container as claimed in claim 39 further comprising means for moving said sensor (32) relative to a gas storage cell (20) disposed in said magnetic chamber (26).

35 41. A container as claimed in claim 39 further comprising a source (30) for a time variant magnetic field disposed in said magnetic chamber (26).

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42. A container as claimed in any one of the preceding claims further comprising a spacer (12,205) so disposed as to maintain said pole shoes (10.1,10.2) in parallel opposed relationship.

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43. A container as claimed in any one of the preceding claims having a double-hulled (200.1,200.2) construction whereby said yoke (2) is provided at least in part by the inner hull (200.2).

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44. A container as claimed in any one of the preceding claims in the form of a magnetic device (1) with an internal space which provides a high-volume, largely homogeneous, shielded magnetic field within its interior, whereby the magnetic device (1) features homogenising μ -metal plates as pole shoes (10.1, 10.2), wherein a ratio of 1:1.5 can be achieved between the useable volume of the magnetic device within which a homogeneous magnetic field is present and the overall volume of the magnetic device and the homogeneity condition

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$$G_r \leq 1.5 \times 10^{-3}/\text{cm}$$

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is fulfilled within the useable volume, whereby G_r is the relative transverse magnetic field gradient.

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45. A gas storage cell (20) containing a nuclear spin polarized gas in a gas storage space surrounded by a cell wall, the wall being of an uncoated material which on the surface contacting said gas storage space is substantially free of paramagnetic substances.

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46. A cell as claimed in claim 45 wherein said wall is of a low iron content glass, the iron content being sufficiently low that the ratio between the wall-related depolarization relaxation time T_1^w for nuclear spin

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polarized ^3He and the volume-to-inner surface area of said cell is at least 10 hours/cm.

47. A method for the removal of a nuclear spin
5 polarized gas from a gas storage cell (20) in a
container as claimed in any one of claims 1 to 38
comprising:

(i) positioning said container with said axis (S)
parallel to the field direction of an external
10 substantially homogeneous magnetic field;

(ii) opening said container by removing a portion
comprising one of said pole shoes (10.1); and

(iii) removing said cell (20) in the direction of
said axis.

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